EDITORIAL

Assessment of mobility after multi-level surgery for cerebral palsy

H. K. Graham,
A. Harvey
From the Royal
Children’s Hospital,
Parkville, Australia

In cerebral palsy, the site and severity of the brain lesion are directly linked to gross motor function and the development of musculoskeletal deformities. The relationship between walking ability and orthopaedic surgery in children with cerebral palsy is not fully understood. The development of new tools such as the Functional Assessment Questionnaire and the Functional Mobility Scale can be used to give new insights on the functional impact of multilevel surgery. These scales are most useful as part of systematic, long-term follow-up.

Many children who suffer from common conditions such as clubfoot and cerebral palsy, live in the developing world where access to expensive technology, such as instrumented gait analysis and botulinum toxin A therapy, may be uneven or restricted. A pragmatic approach to delivering optimal orthopaedic care for such children is essential. The adaptation of the Ponseti method for developing countries is an outstanding example of what can be achieved. However, managing the musculoskeletal manifestations of cerebral palsy without gait laboratories and spasticity management could reasonably be expected to be even more difficult. The report in this issue by Khan is important and encouraging.

In children with cerebral palsy, the prognosis for gross motor function is determined primarily by the location and the extent of the brain lesion responsible for the static encephalopathy. Understanding the process of acquiring gross motor skills in children with cerebral palsy has been greatly enhanced by the work of Rosenbaum et al., who developed the concept of gross motor curves. Using a large database of measurements of the gross motor function measure, they have been able to generate a series of curves that illustrate how the rapid acquisition of motor skills in early childhood is followed by a plateau period, grouped according to the five levels of the gross motor function classification system.

Although the primary determinant of gross motor function is clearly the site and the extent of the brain lesion, deterioration may result from secondary musculoskeletal deformities. This may result in children failing to reach their appropriate gross motor curve, or, in some cases, regressing catastrophically. A child with spastic diplegia may develop such severe contractures that walking becomes impossible, not because of neurological involvement but because of fixed deformities.

In order to track gross motor function longitudinally in children with cerebral palsy, valid and reliable assessments are required that are responsive to change. Ideally, such assessments should be appropriate, reliable, easy to apply and should require minimal training. They are included in the functional mobility scale and the functional assessment questionnaire. The gross motor function classification system is a prognostic tool for stratifying children with cerebral palsy into five broad groups and remains relatively stable over time. It is not an outcome measure and is not designed to be responsive to change after intervention, but it is a vital tool for predicting motor function and in communication about children with cerebral palsy.

Khan has reported the outcome of single-event multi-level surgery in untreated cerebral palsy. This is an interesting study which has great relevance to orthopaedic surgeons who manage deformities in children with cerebral palsy. The patients in this study did not have access to spasticity management, such as injections of Botox, nor instrumented gait analysis in a laboratory. Principally, their management consisted of lengthening the hip flexors, the hamstrings and the gastrosoleus at one operation. A smaller number of children had bony realignment surgery, principally femoral derotation osteotomy. Patients received orthotic...
support and a physiotherapy programme post-operatively. Khan\textsuperscript{2} used a section of the Gillette functional assessment questionnaire,\textsuperscript{7} described as the functional walking scale to assess outcome. Consistent improvement in mobility was found at a minimum of two years follow-up.\textsuperscript{2}

Khan\textsuperscript{2} is to be commended for evaluating his results in this way, and there is a clear message from this paper. The progressive musculoskeletal pathology associated with spastic cerebral palsy affects gross motor function. Function and independence can be improved by multi-level surgery combined with physiotherapy and the use of orthotics. It is important for investigators in this area to record data not only in the domain of impairment, such as range of movement or the presence of contractures, but also in the domains of function and participation using valid tools. Although instrumented gait analysis can give a much more precise description of the baseline characteristics of an individual patient or cohort prior to multi-level surgery, and more accurately evaluate the outcome of individual procedures, there is great value in using valid measures of physical functioning to follow individual patients and study cohorts. Achieving greater levels of independence, such as requiring less assistance to walk, is one goal of multi-level surgery, and this is most conveniently assessed using the functional mobility scale.\textsuperscript{9} The functional assessment questionnaire from the Gillette children’s hospital is a complementary tool\textsuperscript{9} which is also responsive to change after multi-level surgery, but does not include the level of support required for walking.

Much less is known about the development of gross motor function in the second decade of life in children with spastic cerebral palsy, but a number of warning notes can be sounded. It is too easy to correct spastic equinus. Most procedures, especially operations on the tendo Achillis, are much too effective.\textsuperscript{10} The long-term risk is that mild over-correction will lead to a progressive crouch gait around the time of the adolescent growth spurt.\textsuperscript{11} In the long term, this gait pattern is much more disabling than an equinus gait.\textsuperscript{12} The most conservative procedure for lengthening of the calf should be used in multi-level surgery. The aim should be slight under-correction rather than complete- or over-correction.

It is much more difficult to maintain full extension at the knee and the hip than to correct equinus. It is important to continue to look for more effective procedures for the ubiquitous knee flexion contracture. For patients with a mild flexion deformity, a combination of lengthening of the distal hamstring with semitendinous transfer may be better than just simple lengthening of the hamstring.\textsuperscript{13} For those with severe knee flexion contractures, extension osteotomy of the distal femur may be a better solution than repeated lengthening of the hamstring.

The progression of bony torsional deformities and instability of the hip joint and midfoot in the second decade may undermine gains achieved in early childhood from multi-level surgery. Careful longitudinal follow-up is required to detect these problems and deal with them effectively at the appropriate time. An annual physical examination, combined with a video recording of gait and completion of functional scales, is ideal. This combination is clinically effective, cost-effective, and can be easily applied without a gait laboratory.

Khan\textsuperscript{2} will be in a position to make a further substantial contribution to our understanding of the interaction between musculoskeletal deformity and gross motor function in children with cerebral palsy, if he can maintain the follow-up of this cohort to skeletal maturity and beyond.

References